

NON-PUBLIC?: N
ACCESSION #: 9106180298
LICENSEE EVENT REPORT (LER)

FACILITY NAME: D. C. Cook Nuclear Plant - Unit 1 PAGE: 1 OF 04

DOCKET NUMBER: 05000315

TITLE: Reactor Protection System Actuation Due to Reactor Coolant Pump
Bus Undervoltage Caused by Main Generator Voltage Regulator
Failure

EVENT DATE: 05/12/91 LER #: 91-004-00 REPORT DATE: 06/11/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: P. F. Carteaux - Safety and TELEPHONE: (616) 465-5901
Assessment Superintendent

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: TL COMPONENT: EC MANUFACTURER: G080

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On May 12, 1991 at 0826 hours while performing a main generator "maximum reactive capability" test, a Reactor Protection System actuation (reactor trip sequence) occurred.

The reactor trip was due to an undervoltage condition sensed on the reactor coolant pump (4KV) busses. An investigation concluded that the bus undervoltage condition was due to a decrease in main generator output voltage. This decrease resulted from a transfer from automatic to manual control of the main generator voltage, which was initiated by the malfunction of a protective "exciter field current limiter" device.

The main generator voltage regulation system "exciter field current

limiter panel" has been determined to be defective. This component will be replaced. Changes have been made to appropriate operating procedures requiring the matching of manual and automatic main generator voltage regulator setpoints. This will avoid large deviations between setpoints and will enhance electrical distribution system stability during any future transfers of main generator voltage regulation from automatic to manual control.

END OF ABSTRACT

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Conditions Prior to Occurrence

Unit 1 was in Mode 1 (power operation) at approximately 100 percent of Rated Thermal Power. A "maximum reactive capability" test was in progress.

Description of Event

At 2240 hours on May 11, 1991, performance of procedure **1-OHP SP.070 "Establishing Demonstrated Generator Reactive Limits" commenced. This test procedure calls for the adjustment of main generator (EIIS/TB) reactive loading as far into the underexcited and overexcited regions of the normal operating band as possible while maintaining stator water temperature, main generator reactive loading, main generator output voltage, and main turbine (EIIS/TA-TRB) vibration within specified limits. The underexcited and overexcited conditions are each maintained for a period of approximately six hours. At the beginning and end of each six hour period, main generator related parameters are recorded. During the waiting period with the main generator in the overexcited condition (procedure **1-OHP SP.070, step 6.2.3), main generator voltage control transferred from the automatic voltage regulator (EIIS/TL-EC) to the manual voltage regulator (EIIS/TL-EC). The "Voltage Regulator Failure" annunciator was received, followed by the "Train A Aux Busses Undervoltage" and "Train B Aux Busses Undervoltage" annunciators. At 0826 hours on May 12, 1991, and approximately two seconds after receipt of the above annunciators, the reactor trip on reactor coolant pump (RCP) bus (EIIS/EA-BU) undervoltage actuated. Because the emergency busses (EIIS/EA-BU) were being powered from the RCP busses, they also experienced an undervoltage condition. This resulted in an automatic opening of the bus cross-tie breakers (EIIS/EA-BKR) supplying the emergency busses from the RCP busses. As designed, the AB and CD emergency diesel generators (EIIS/EK) automatically started and supplied power to their respective emergency busses.

When the undervoltage condition on the RCP busses satisfied reactor protection system (EIS/JE) setpoints and coincidence logic, the reactor trip sequence was initiated, including main turbine trip, automatic starting of the motor-driven (EIS/BA-P) and turbine-driven (EIS/BA-P) auxiliary feedwater pumps, opening of the reactor trip breakers (EIS/JE-BKR), insertion of all control rods (EIS/AA-ROD) and main feedwater isolation (EIS/JB). Control room Reactor Operators immediately performed the applicable emergency operating procedures to verify proper response of the automatic protection system, to assess plant conditions, and to implement appropriate recovery actions.

Automatic loading of "blackout loads" onto the re-energized emergency busses was verified by the Operators. Seal injection flow was restored to the reactor coolant pumps (EIS/AB-P) by manually starting a centrifugal charging pump (EIS/CB-P), which had been "load shed" from its emergency bus when that bus was de-energized. Pressurizer heaters (EIS/AB-EHTR) and chemical and volume control system (CVCS) (EIS/CB) letdown flow were also manually restored. Although reactor coolant pump bus voltage was initially degraded, the busses remained energized, maintaining operation of the reactor coolant pumps, circulating water pumps (EIS/SG-P), and other major balance-of-plant pumps. The brief de-energization of the emergency busses

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resulted in the loss of a number of minor loads which were not automatically restored when the emergency busses were re-energized. These include normal control room lighting (EIS/FF), steam generator parameter recorders (EIS/AB-TR), control rod bottom lights (EIS/AA-ZI), component cooling water temperature indications (EIS/CC-TI), and alternating current lubricating oil pumps (EIS/TD-P). The turbine-driven auxiliary feedwater pump was stopped and auxiliary feedwater flow was reduced to stop a minor reactor coolant system (EIS/AB) cooldown, during which the reactor coolant System average temperature decreased to approximately 534 degrees Fahrenheit. Radiation monitors (EIS/IL) ERS 1300, ERS 1400, VRS 1500, and SRA 1900 became inoperable when the emergency busses de-energized, due to loss of power supply. The lighting transformer (EIS/FF-XFMR) was re-energized at 0935, which restored power to normal control room lighting and other minor loads which had lost power at the time of the reactor trip. By 0947 hours, power to all emergency busses from the normal supply (from RCP busses via cross-tie breakers) had been restored. Glycol refrigerant flow to the ice condensers (EIS/BC), which had been isolated by closure of valves 1-VCR-10 and 1-VCR-20 (EIS/NH-ISV) at the time of the reactor trip, was restored at 1104 hours.

Cause of the Event

The cause of the reactor trip, as determined from the operation sequence monitor and plant computer printouts, and consistent with the observed sequence of events, was actuation of the reactor protection system (RPS) due to sensed undervoltage on two of the four RCP busses. This RPS function is described in Technical Specifications 2.2.1, Table 2.2-1 item 15 and 3.3.1.1, Table 3.3-1 item 16. The undervoltage condition on the RCP busses was the result of a decrease in main generator output voltage while the RCP busses were being powered by the main generator. The decrease in main generator output voltage resulted from the automatic transfer of main generator voltage control from the automatic voltage regulator to the manual voltage regulator. The specific causes for the generator and distribution system electrical transients which followed the transfer have not been positively identified. The automatic transfer of main generator voltage regulation from automatic to manual control was not appropriate for the existing conditions. A protective device in the main generator exciter circuitry, the "exciter field current limiter panel", initiated the transfer. This device has been determined to be defective. The device may have actuated early due to an erroneous setpoint, or it may have experienced an electronic failure which induced the transfer.

Analysis of the Event

This event is being reported in accordance with 10 CFR 50.73 (a)(2)(iv) as an event that resulted in an unplanned automatic actuation of engineered safety features, including the reactor protection system.

The automatic protective functions associated with the reactor trip sequence were verified to have functioned properly. On de-energization of the emergency 4KV busses, the emergency diesel generators automatically started and powered their associated emergency busses as designed and in accordance

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with applicable accident analyses. Except for a brief period when bus voltage was degraded, offsite power was always available from the normal reserve supply. The emergency busses could, if required, have been loaded to this supply quickly using the guidance in existing emergency operating procedures. In addition to this, offsite power remained available via the Emergency Power (EP) distribution system. The Technical Specification action statements for radiation monitors which became inoperable were met, until monitor operability could be restored. Based on the above, it is concluded that this reactor trip event did not

constitute an unreviewed safety question as defined in 10 CFR 50.59(a)(2), nor did it adversely impact the health and safety of the public.

Corrective Action

An investigation resulted in the identification of a failed main generator voltage regulation "exciter field current limiter panel". This item will be replaced when the required new component has been procured. Pending installation of this replacement component, administrative controls have been placed on the operation of the main generator to ensure that main generator exciter parameters do not approach values at which unit operation may be affected by the failed component. In addition to this, operating procedures have been changed to require periodic verification that manual generator voltage regulator and automatic generator voltage regulator setpoints are closely matched. This should enhance electrical distribution system stability in the event of any future transfer from automatic to manual main generator voltage control.

Failed Components

Plant Designation: Exciter Field Current Limiter Panel

Manufacturer: General Electric

Model: 357932 JA115A3

EIIS Code: TL-EC

Previous Similar Events

LER 50-316/87-007

ATTACHMENT 1 TO 9106180298 PAGE 1 OF 1

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INDIANA
MICHIGAN
POWER

June 11, 1991

United States Nuclear Regulatory Commission
Document Control Desk
Rockville, Maryland 20852

Operating Licenses DPR-58
Docket No. 50-315

Document Control Manager:

In accordance with the criteria established by 10 CFR 50.73 entitled
Licensee Event Report System, the following report is being submitted:

91-004-00

Sincerely,

A. A. Blind
Plant Manager

AAB:sb

Attachment

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